Supplementary Materials for:

Origin, structure and geochemistry of a rock glacier near Don Juan Pond, Wright Valley, Antarctica

Winsor, K. [1,#], Swanger, K.M. [1,*], Babcock, E.L. [2], Dickson, J.L.[3], Valletta, R.D. [4], Schmidt, D.F. [5]

[1] Department of Environmental, Earth and Atmospheric Sciences, University of Massachusetts, Lowell, MA 01854

[2] Logic Geophysics & Analytics LLC, Anchorage, AK 99508

[3] Division of Geological & Planetary Sciences, California Institute of Technology, Pasadena, CA 91125

[4] Franklin Institute, Philadelphia, PA 19103

[5] Department of Plastics Engineering, University of Massachusetts, Lowell, MA 01854

[#] Now at: School of Earth and Sustainability, Northern Arizona University, Flagstaff, AZ 86005

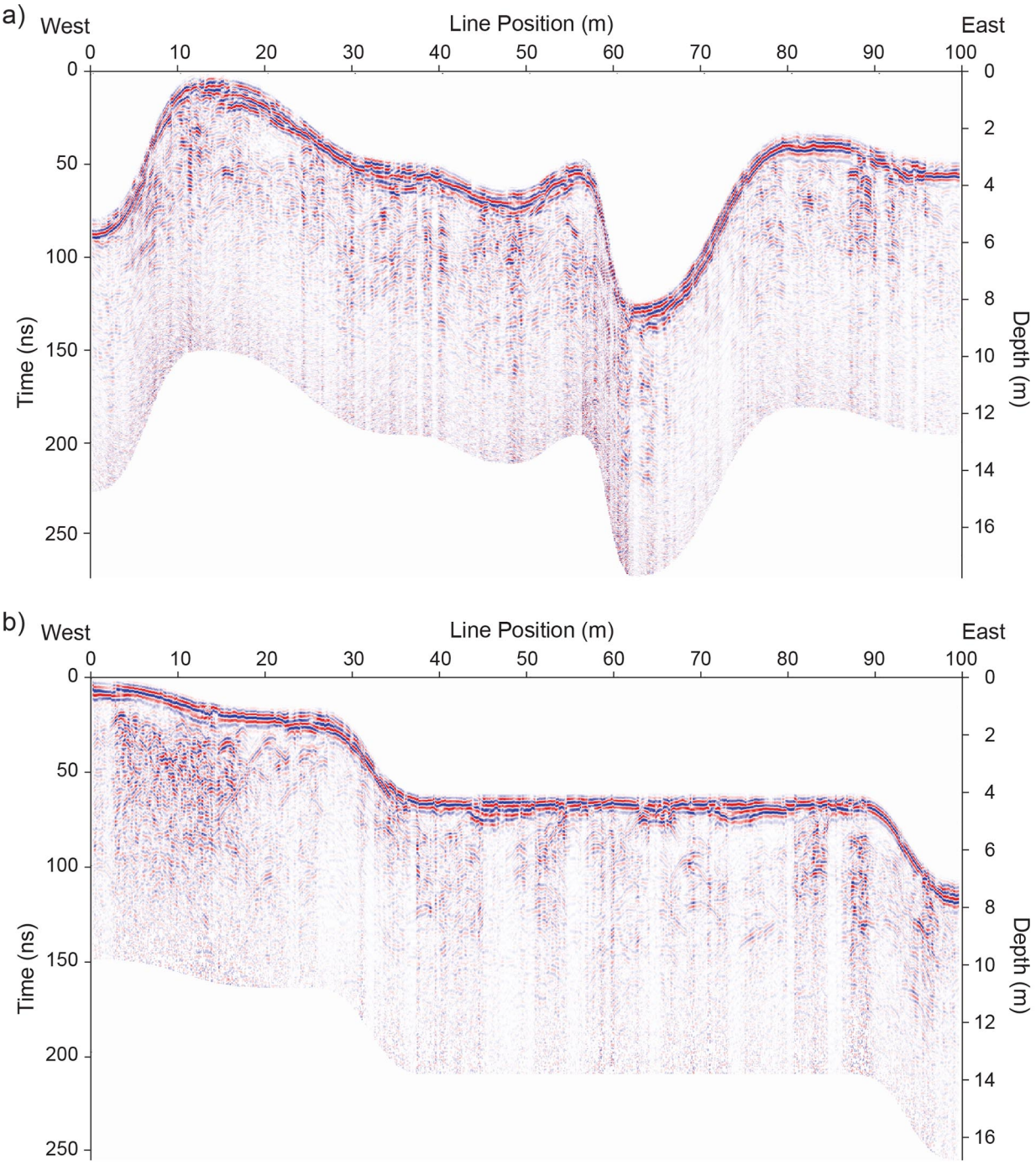

Figure S1. Ground-penetrating radar data gathered with the 200 MHz antenna. (a) Line 1 in the middle South Fork rock glacier, ~2 km upflow from the terminus. (b) Line 2 in the middle South Fork rock glacier, ~1.8 km upflow from the terminus.

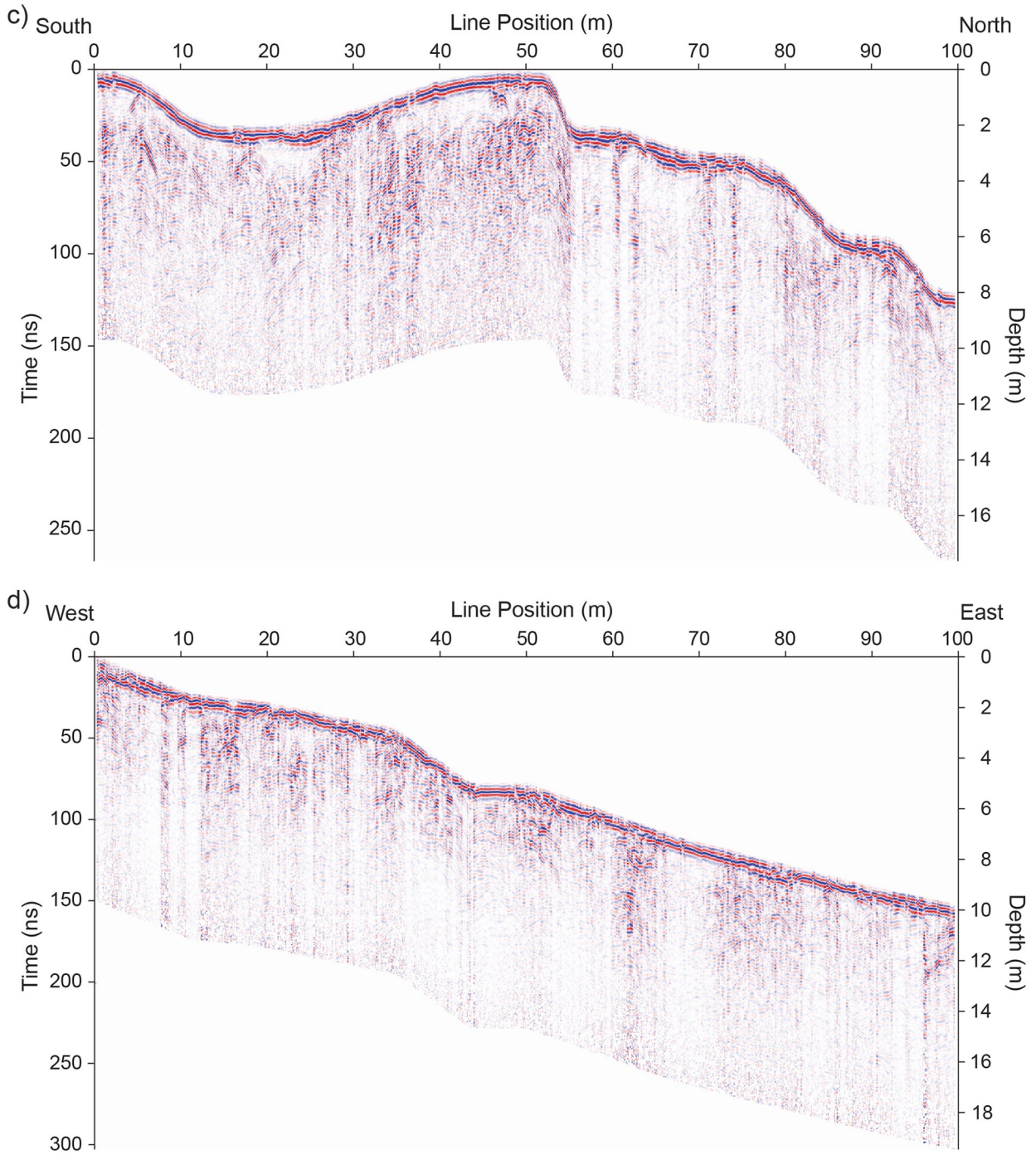

Figure S1. Ground-penetrating radar data gathered with the 200 MHz antenna. (c) Line 3 in the middle South Fork rock glacier, ~1.8 km upflow from the terminus. (d) Line 4 in the South Fork rock glacier, ~1 km upflow from the terminus.

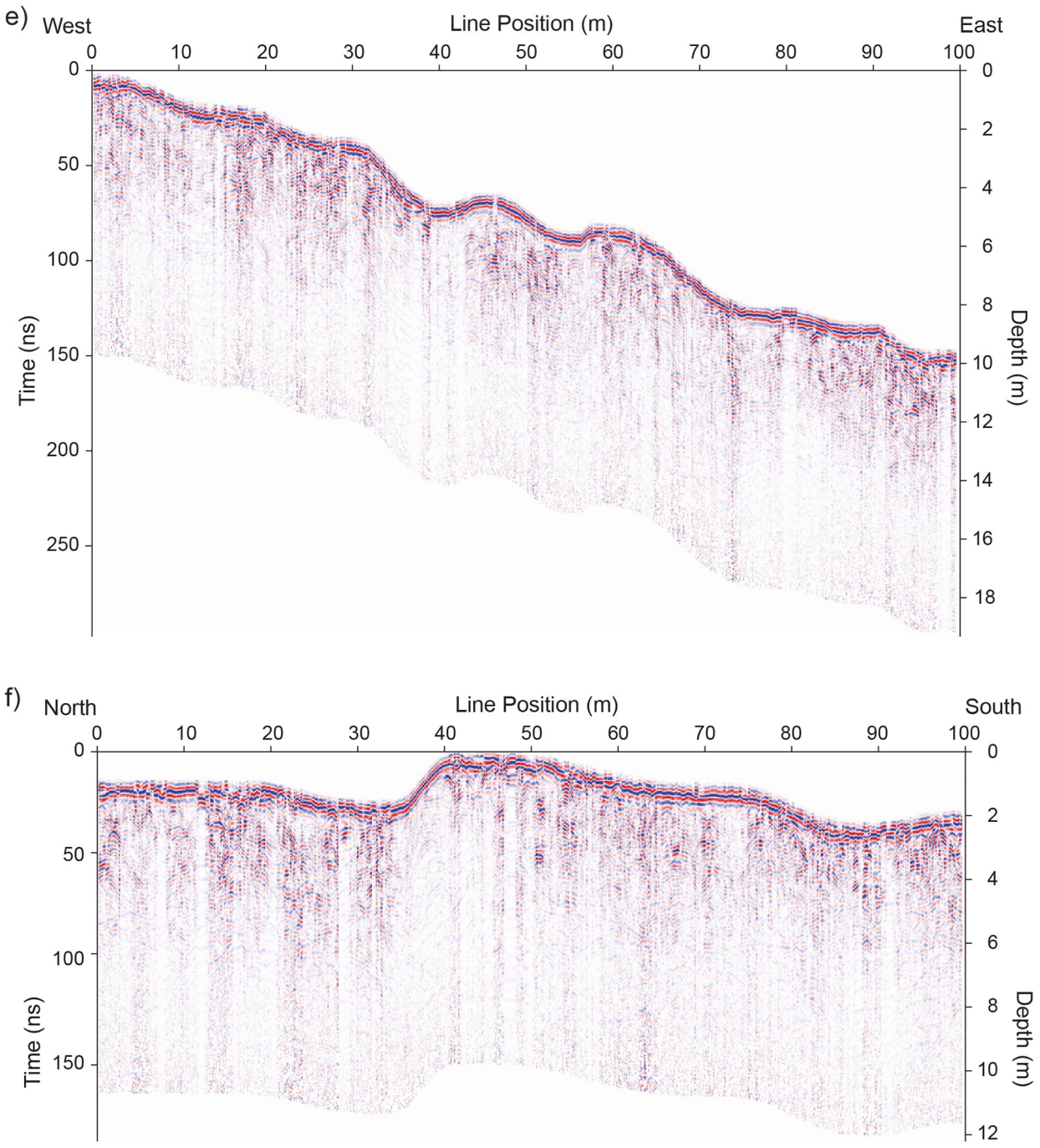

Figure S1. Ground-penetrating radar data gathered with the 200 MHz antenna. (e) Line 5 in the South Fork rock glacier, ~0.9 km upflow from the terminus. (f) Line 6 in the South Fork rock glacier, ~0.8 km upflow from the terminus.

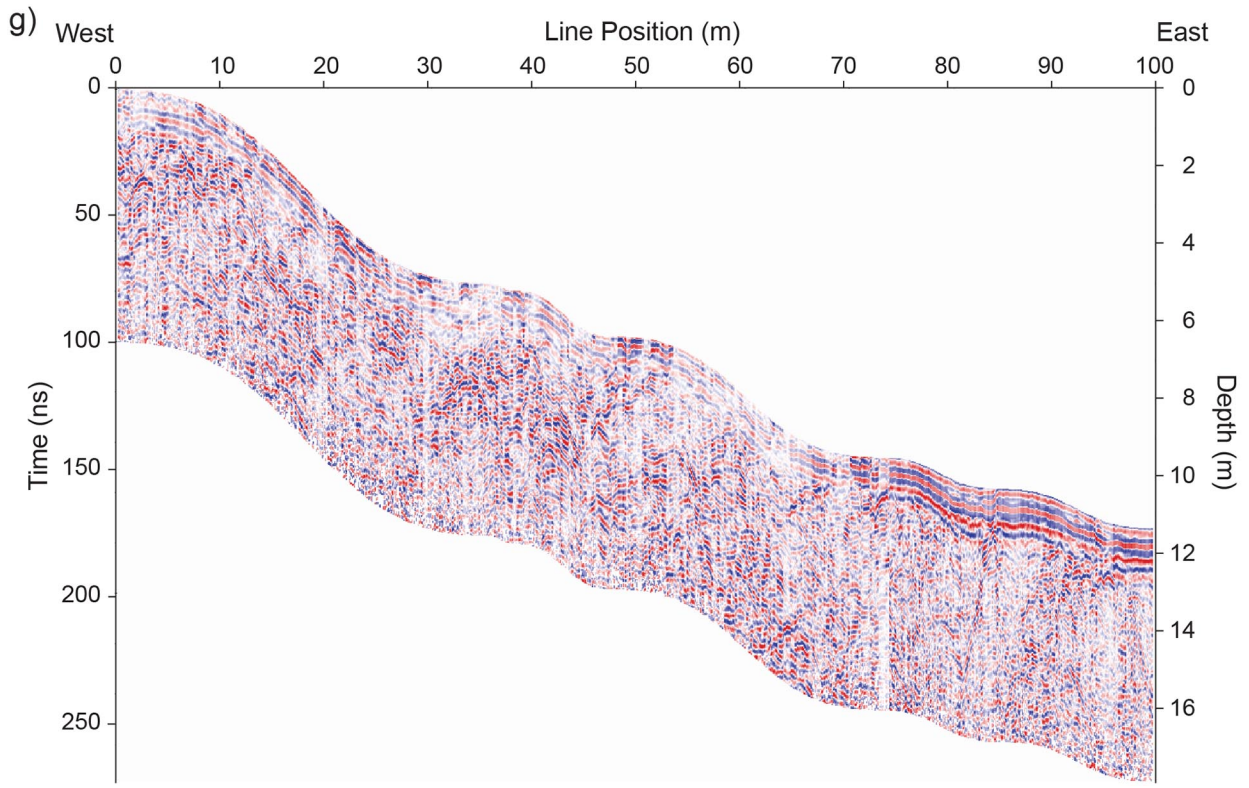

Figure S1. Ground-penetrating radar data gathered with the 200 MHz antenna. (g) Line 7 in the South Fork rock glacier, ~0.4 km upflow from the terminus.

Supplementary Online Material: Table S1. Sediment and rock samples from South Fork rock glacier and slope near Don Juan Pond. For sediment and pond samples, the depth range is given. Page 1.

Sample Name	Depth (cm below ground surface)	Sample Type	Latitude (S)	Longitude (E)	Elevation (m above sea level)	GPS Uncertainty (m)
KWE-92	1–3	Sediment	77.56565	161.16828	158	7
KWE-93	1–3	Sediment	77.56543	161.16823	154	9
KWE-94	1–4	Sediment	77.56523	161.16827	141	8
KWE-95	1–3	Sediment	77.5654	161.171	159	8
KWE-96	0–3	Sediment	77.56538	161.17133	147	14
KWE-97	1–2	Sediment	77.56573	161.17187	173	8
KWE-98	0–3	Sediment	77.56505	161.17387	173	12
KWE-99	0–2	Sediment	77.56503	161.17676	127	14
KWE-100	0–3	Sediment	77.56395	161.17461	138	7
KWE-101	0–3	Sediment	77.56341	161.17546	134	13
KWE-102	0–3	Sediment	77.56300	161.17436	146	13
KWE-103	0–3	Sediment	77.56475	161.18552	292	7
KWE-104	0–2	Sediment	77.56475	161.18552	292	7
KWE-105	0–2	Sediment	77.56412	161.20647	133	13
KWE-106	0–2	Sediment	77.56399	161.20819	128	12
KWE-107	0–2	Sediment	77.56399	161.20819	128	12
KWE-108	0–2	Sediment	77.56442	161.2007	125	7
KWE-109	0–2	Sediment	77.56445	161.19858	132	6
KWE-110	3–6	Sediment	77.56445	161.20053	133	6
KWE-111	0–2	Sediment	77.563733	161.2068	142	10
KWE-111	2–5	Sediment	77.563733	161.2068	142	10
KWE-112	0–2	Sediment	77.56275	161.20842	141	7
KWE-112	6–9	Sediment	77.56275	161.20842	141	7
KWE-113	0–2	Sediment	77.562017	161.1725	130	9
KWE-113	6–8	Sediment	77.562017	161.1725	130	9
KWE-114	0–2	Sediment	77.5617	161.1709	151	10
KWE-114	8–10	Sediment	77.5617	161.1709	151	10
KWE-115	2–4	Sediment	77.561417	161.17113	128	8
KWE-115	10–13	Sediment	77.561417	161.17113	128	8
KWE-116	3–5	Sediment	77.5619	161.16722	159	7
KWE-117	0–3	Sediment	77.5629	161.16653	184	10
KWE-118	1–3	Sediment	77.5629	161.16653	184	10
KWE-119	1–4	Sediment	77.5643	161.1551	193	7
KWE-119	6–9	Sediment	77.5643	161.1551	193	7
KWE-120	0–2	Sediment	77.5643	161.1551	193	7
KWE-121	0–3	Sediment	77.562317	161.1525	203	12
KWE-121	15–18	Sediment	77.562317	161.1525	203	12
KWE-121	12–15	Sediment	77.562317	161.1525	203	12
KWE-122	0–3	Sediment	77.562483	161.13517	259	8
KWE-123	1–4	Sediment	77.563	161.13597	253	6
KWE-123	10–12	Sediment	77.563	161.13597	253	6
KWE-124	0–3	Sediment	77.563	161.13597	253	6
KWE-125	1–4	Sediment	77.564667	161.13848	235	10
KWE-125	8–10	Sediment	77.564667	161.13848	235	10
KWE-126	0–2	Sediment	77.564667	161.13848	235	10
KWE-127	1–3	Sediment	77.564683	160.93948	779	6
KWE-127	6–9	Sediment	77.564683	160.93948	779	6
KWE-128	1–3	Sediment	77.563633	160.94862	717	6
KWE-129	0–2	Sediment	77.5628	160.95315	697	5
KWE-130	1–3	Sediment	77.560383	160.95415	643	5
KWE-130	6–8	Sediment	77.560383	160.95415	643	5
KWE-131	1–3	Sediment	77.558383	160.9438	645	8
KWE-131	6–6.5	Sediment	77.558383	160.9438	645	8
KWE-132	1–3	Sediment	77.5582	160.94552	642	8
KWE-133	1–3	Sediment	77.557867	160.95108	639	7
KWE-134	1–3	Sediment	77.55755	161.01265	473	6
KWE-135	0–3	Sediment	77.56615	161.15657	185	12

Supplementary Online Material: Table S1. Sediment and rock samples from South Fork rock glacier and slope near Don Juan Pond. For sediment and pond samples, the depth range is given. Page 2.

Sample Name	Depth (cm below ground surface)	Sample Type	Latitude (S)	Longitude (E)	Elevation (m above sea level)	GPS Uncertainty (m)
KWE-135	8–10	Sediment	77.56615	161.15657	185	12
KWE-135	12–14	Sediment	77.56615	161.15657	185	12
KWE-136	1–3	Sediment	77.5675	161.15602	259	8
KWE-136	12–14	Sediment	77.5675	161.15602	259	8
KWE-137	1–3	Sediment	77.5675	161.15602	259	8
KWE-138	1–3	Sediment	77.5656	161.1556	199	8
KWE-139	1–4	Sediment	77.5687	161.13725	281	8
KWE-139	4–7	Sediment	77.5687	161.13725	281	8
KWE-139	30–35	Sediment	77.5687	161.13725	281	8
KWE-140	2–6	Sediment	77.568867	161.13937	292	7
KWE-141	1–4	Sediment	77.56745	161.13808	255	12
KWE-142	0–4	Sediment	77.5665	161.13693	249	8
KWE-143	1–4	Sediment	77.563	161.13418	243	12
KWE-144	1–4	Sediment	77.562567	161.13252	265	6
KWE-145	1–4	Sediment	77.563817	161.11443	289	7
KWE-146	1–5	Sediment	77.56425	161.11482	298	6
KWE-146	12–14	Sediment	77.56425	161.11482	298	6
KWE-147	0–3	Sediment	77.563683	161.0998	322	7
KWE-148	1–4	Sediment	77.564283	161.09973	330	8
KWE-149	1–3	Sediment	77.562433	161.08795	381	10
KWE-149	3–4	Sediment	77.562433	161.08795	381	10
KWE-150	1–4	Sediment	77.562533	161.08507	324	8
KWE-151	1–4	Sediment	77.563383	161.08337	326	6
KWE-152	1–4	Sediment	77.56455	161.08078	357	9
KWE-152	10–12	Sediment	77.56455	161.08078	357	9
KWE-153	0–2	Sediment	77.562183	161.08332	332	15
KWE-154	1–4	Sediment	77.561333	161.08065	328	9
KWE-154	8–9	Sediment	77.561333	161.08065	328	9
KWE-155	1–4	Sediment	77.560733	161.07245	316	8
KWE-156	0–2	Sediment	77.559217	161.06595	328	9
KWE-157	1–4	Sediment	77.561633	161.06697	353	9
KWE-157	15–18	Sediment	77.561633	161.06697	353	9
KWE-158	2–5	Sediment	77.566333	161.07967	376	7
KWE-158	10–14	Sediment	77.566333	161.07967	376	7
KWE-159	2–5	Sediment	77.567317	161.07748	403	9
KWE-160	1–4	Sediment	77.566367	161.08805	355	5
KWE-160	9–12	Sediment	77.566367	161.08805	355	5
KWE-161	1–4	Sediment	77.567133	161.08883	359	10
KWE-162	0–4	Sediment	77.568517	161.08875	390	11
KWE-163	1–4	Sediment	77.568767	161.08842	395	11
KWE-164	1–4	Sediment	77.56675	161.10408	315	9
KWE-165	1–4	Sediment	77.568083	161.10695	326	7
KWE-165	12–15	Sediment	77.568083	161.10695	326	7
KWE-166	0–3	Sediment	77.568733	161.1131	306	6
KW-SFR-01		Rock	77.56475	161.18552	292	7
KW-SFR-02		Rock	77.56475	161.18552	292	7
KW-SFR-03		Rock	77.564358	161.205430	123	7
KW-SFR-04		Rock	77.564417	161.15605	187	9
KW-SFR-05		Rock	77.563983	160.93955	779	7
KW-SFR-06		Rock	77.564683	160.93948	779	6
KW-SFR-07		Rock	77.558383	160.9438	645	8
KW-SFR-08		Rock	77.557567	160.94643	654	9
KW-SFR-09		Rock	77.560033	160.95133	645	11
KW-SFR-10		Rock	77.5675	161.15602	259	8
KW-SFR-11		Rock	77.5656	161.1556	199	8
KW-SFR-12		Rock	77.568667	161.1392	290	6
KW-SFR-13		Rock	77.568667	161.1392	290	6

Supplementary Online Material: Table S1. Sediment and rock samples from South Fork rock glacier and slope near Don Juan Pond. For sediment and pond samples, the depth range is given. Page 3.

Sample Name	Depth (cm below ground surface)	Sample Type	Latitude (S)	Longitude (E)	Elevation (m above sea level)	GPS Uncertainty (m)
KW-SFR-14		Rock	77.568667	161.1392	290	6
KW-SFR-15		Rock	77.568667	161.1392	290	6
KW-SFR-16		Rock	77.5635	161.11852	288	13
KW-SFR-17		Rock	77.563683	161.0998	322	7
KW-SFR-18		Rock	77.563683	161.0998	322	7
KW-SFR-19		Rock	77.562533	161.08507	324	8
KW-SFR-20		Rock	77.565067	161.14937	177	11
KW-SFR-20		Rock	77.5641	161.14913	211	8
KW-SFR-20		Rock	77.564117	161.1525	210	10
KW-SFR-20		Rock	77.565	161.15315	198	9
KW-SFR-21		Rock	77.56385	161.1581	166	9
KW-SFR-21		Rock	77.56485	161.15855	190	8
KW-SFR-21		Rock	77.564683	161.16232	173	7
KW-SFR-21		Rock	77.563817	161.16177	180	6
KW-SFR-22		Rock	77.568433	161.08907	389	8

Supplementary Online Material: Table S2. Major mineral components of sediment samples, as determined through X-ray powder diffraction.

Sample	Depth	Quartz	Halite	Feldspar	Pyroxene	Gypsum	Thenardite / Mirabilite	Bloedite	Sylvite	Clay	Mica
SOUTH OF DJP											
KWE-15-104	0–2	-	X			-					
KWE-15-105	0–2	X	X	X		-					
KWE-15-106	0–2	X	X	X		X					
KWE-15-108	0–2	-	X			-					
KWE-15-109	0–2	X	X	X		-	-	-			
KWE-15-110	3–6	X	X	-		-					
LOWER											
KWE-15-092	1–3	X	X	X	X		-	-			
KWE-15-093	1–3	X	X	X	X		-	-	-	-	
KWE-15-094	1–4	X	-	X	X				X		
KWE-15-095	1–3	X	-	X	X					X	
KWE-15-097	1–2	X	-	X	X	X	-	-	X	-	
KWE-15-098	0–3	X	X	X	X			-			
KWE-15-100	0–3	X		X	X		-	-		-	-
KWE-15-101	0–3	X	X	X			-		X		
KWE-15-113	0–2	X		X	X			-			
KWE-15-113	6–8	X		X	X						
KWE-15-115	2–4	X		X	X	-	X				-
KWE-15-115	10–13	X	X	X	X	X	-	-		X	-
KWE-15-118	1–3	X		X	X						
KWE-15-119	1–4	X		X	X						
KWE-15-119	6–9	X		X	X				X		
KWE-15-120	0–2	X		X	-					-	
KWE-15-121	0–3	X		X	X						
KWE-15-121	12–15	X	-	X	X						
KWE-15-138	1–4	X		X	X		-				
KWE-15-138	8–10	X	X	X	X		-				
MIDDLE											
KWE-15-123	1–3	X	-	X	X		-				
KWE-15-126	8–10	X		X	X						
KWE-15-139	4–7	X	X	X	X						
KWE-15-142	0–4	X	-	X	X						-
KWE-15-160	1–4	X		X	X		-				
KWE-15-160	9–12	X	X	X	X		-				
KWE-15-161	1–4	X		X	X		-				
KWE-15-162	0–4	X		X	X						
KWE-15-164	1–4	X	X	X	X		-	-			
KWE-15-165	1–4	X	X	X	X				-		
UPPER											
KWE-15-127	1–3	X		X	X						
KWE-15-129	0–2	X	X	X	X					X	
KWE-15-130	6–8	X	X	X	X						

Higher confidence levels in mineral presence (relative peak intensity of >1%) are indicated by X. Lower confidence levels (relative peak intensity of <1%) are indicated by a dash.